MULTIMEDIA UNIVERSITY

STUDENT ID NO

Seat No.: | | | |

Venue: _____

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

TGD2151 – COMPUTER GRAPHICS FUNDAMENTALS
TCS2111 - COMPUTER GRAPHICS

(All sections / Groups)

21 OCTOBER 2017
2.30 p.m. – 4.30 p.m.
(2 Hours)

Question No.	Marks
1	
2	
3	
4	
Total	

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 7 pages with 4 Questions only.

2. Answer **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.

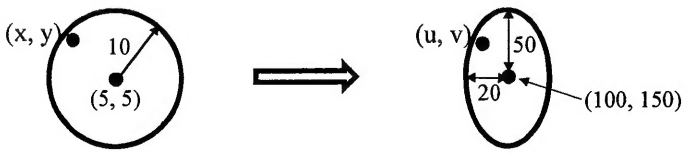
3. Please write all your answers CLEARLY in this Question paper.

QUESTION 1

a) In graphics program, one needs to deal with multiple coordinate systems and the conversion of the coordinates from one system to another. Describe the following coordinate systems: [5 marks]

i) World Coordinate System
ii) Object Coordinate System
iii) Viewpoint Coordinate System
iv) Screen Coordinate System
v) Viewport Coordinate System

b) Window-to-Viewport mapping is the process of mapping or transforming a two-dimensional, world-coordinate scene to device coordinates. Find the window to viewport transformation for the figure below. [3 marks]



Continued...

c) What is the size of the frame buffer required (in Kilo-bytes, Kb) for a raster system with resolution 1280 x 1024 to store 12 bits per pixel? [2 marks]

QUESTION 2

a) Determine whether each statement of line-clipping algorithms (Cohen-Sutherland algorithm, Liang-Barsky algorithm, Cyrus-Beck algorithm, Nicholl-Lee-Nicholl algorithm and Fast Clipping algorithm) below is **True (T)** or **False (F)**. Note: **Circle your answer!** [5 marks]

i) Cohen-Sutherland algorithm divides a 2D space into 9 regions, of which only the middle part is visible. [T / F]

ii) Liang-Barsky algorithm uses the parametric equation of a line and inequalities to describe the range of the clipping box to determine the intersections between the line and the clipping box. [T / F]

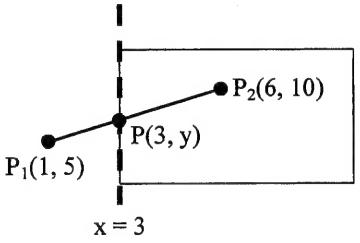
iii) Cyrus-Beck algorithm is a simplified version of Liang-Barsky algorithm that was optimized for a rectangular clip window. [T / F]

Continued...

iv) Nicholl-Lee-Nicholl algorithm is a fast line-clipping algorithm that reduces the chances of clipping a single line segment multiple times, as may happen in the Cohen-Sutherland algorithm. [T / F]

v) Fast clipping algorithm shares the similarity with Cohen-Sutherland that the start and end positions are classified by which portion of the 9-area grid they occupy. [T / F]

b) Using Cohen-Sutherland line-clipping algorithm, show the conditions of Trivial Accept and Trivial Reject for the line below. Then, compute the intersection point and state the new end point. [5 marks]



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QUESTION 3

a) i) What is the 2D composite matrix in homogeneous form if an object is scaled with the scaling factor (2, 3) and translated 4 units along x-axis and 3 unit along y-axis.
[3 marks]

ii) What is the resultant coordinate of point P' if the transformation event in Q3a(i) is applied to the point P at (3, 6). [2 marks]

b) Although Depth-buffer method (Z-buffer method) is simple to implement for detecting visible surfaces, why it is not in favour by many researchers? Give two (2) reasons.
[2 marks]

Continued...

c) Determine whether the surfaces below is visible to the viewer.
i) A surface with normal vector (0, 1, 0) and the viewer is looking at direction (2, 3, 1).
ii) A surface with normal vector (2, 0, -3) and the viewer stands at coordinate (2, 1, -4) looking at the surface. [3 marks]

QUESTION 4

a) i) What is local illumination model? Give one (**1**) example. [2 marks]

ii) Compute the intensity of the diffuse reflection and specular reflection at a point P if the unit light vector $\boldsymbol{L}$ is (-1, 1, 2), normal vector $\boldsymbol{N}$ is (0, 1, 0), unit viewer vector $\boldsymbol{V}$ is (0, 2, 1), intensity of the diffuse light and specular light are $I_d = 1.0$ and $I_s = 0.6$ respectively, and the coefficient of the diffuse light and specular light are $K_d = 0.5$, $K_s = 0.5$ and Specular reflection exponent, $n = 10$. [4 marks]

Continued...

b) A point light source P located at (1, 2, 0) with the light intensity $I_p = 0.9$. Compute the intensity of the light at point Q(1, -2, 5) on a surface if the light attenuation factor is $f = \frac{1}{a_0 + a_1 d}$, where d is the distance, $a_0 = 0.5$ and $a_1 = 1.0$. [3 marks]

c) Discuss the following shading methods: [1 mark]

i.) Gouraud shading

ii.) Phong shading

End of Page!